What is claimed is

1. A system for recovering methane from a feed mixture comprising methane, carbon dioxide and volatile organic compounds, the system comprising,

a pressure swing adsorption unit having a bed of adsorbent particles and operative to adsorb volatile organic compounds from the feed mixture onto the particles so as to produce an intermediate mixture of gases having composition reduced in volatile organic compounds relative to the feed mixture, and operative to desorb the volatile organic compounds from particles into a regenerating gas,

a primary gas separation module comprising a membrane which is selectively gas permeable to methane relative to carbon dioxide, a feed-retentate chamber within the module on a first side of the membrane, and a permeate chamber within the module on a second side of the membrane, in which the feed-retentate chamber is in fluid communication with the bed of the pressure swing adsorption unit in a manner adapted to permit transfer of the intermediate mixture into the feed-retentate chamber in contact with the first side of the membrane,

a retentate discharge line in fluid communication with the feed-retentate chamber adapted to withdraw from the module a retentate gas having composition enriched in methane relative to the intermediate mixture,

a permeate discharge line in fluid communication between the permeate chamber of the module and the bed of the pressure swing adsorption unit and which is operative to transfer a permeate gas having composition depleted in methane relative to the intermediate mixture and which permeate gas is adapted to receive desorbed volatile organic compounds from the particles of the bed to form a spent regenerating gas, and

a thermal oxidizing unit in fluid communication with the pressure swing adsorption unit which is operative to destroy the volatile organic compounds in the spent regenerating gas and to produce a vent gas having composition substantially free of volatile organic compounds.

2. The system of claim 1 which further comprises a secondary gas separation module comprising a membrane which is selectively gas permeable to methane relative to

carbon dioxide, a secondary feed-retentate chamber within the module on a first side of the membrane, and a secondary permeate chamber within the module on a second side of the membrane, in which the secondary feed-retentate chamber is in fluid communication with the retentate discharge line of the primary gas separation module in a manner adapted to permit transfer of the retentate gas from the primary module into the secondary feed-retentate chamber.

3. The system of claim 2 which further comprises a recycle transfer line in fluid communication with the secondary feed-retentate chamber and adapted to return a recycle stream of gas permeated through the membrane of the secondary gas separation module into the feed mixture.

4. The system of claim 1 which comprises a plurality of pressure swing adsorption units connected in parallel fluid communication in a manner adapted to transfer the feed mixture through the bed of at least one active pressure swing adsorption unit and into the feed-retentate chamber of the primary gas separation module, and to simultaneously transfer the permeate gas from the primary gas separation module through the bed of at least one regenerating pressure swing adsorption unit other than the active unit.

5. The system of claim 1 in which the adsorbent particles comprise adsorbent materials selected from the group consisting of activated alumina, silica gel, activated carbon and mixtures thereof.

6. A process for separating methane from a feed mixture comprising methane, carbon dioxide and volatile organic compounds that utilizes a pressure swing adsorption unit operation to remove the volatile organic compounds from the feed mixture to form an intermediate mixture and a selectively gas permeable membrane to separate methane from the intermediate mixture and thereby produce a permeate gas having composition depleted in methane relative to the intermediate mixture, in which the improvement comprises regenerating the pressure swing adsorption units by conducting the permeate gas through the pressure swing adsorption units which have adsorbed a preselected amount of the volatile organic compounds.

7. The process of claim 6 in which the pressure swing adsorption units contain a loaded inventory of parts by weight volatile organic compounds per 100 parts by weight adsorbent particles when saturated and which process further comprises conducting the permeate gas through the pressure swing adsorption units under operating conditions including pressure, temperature and duration effective to remove at least about 90 % of the loaded inventory.

8. A process for separating methane from a feed mixture comprising methane, carbon dioxide and volatile organic compounds comprising the steps of:

(A) providing a plurality of pressure swing adsorption units each having a bed of adsorbent particles operative to reversibly adsorb the volatile organic compounds from the feed mixture onto the particles,

(B) charging the feed mixture into an active pressure swing adsorption unit and contacting the feed mixture with the adsorbent particles under operating conditions including pressure and temperature to cause the volatile organic compounds to adsorb onto the particles,

(C) withdrawing from the active pressure swing adsorption unit an intermediate mixture having composition reduced in volatile organic compounds relative to the feed mixture,

(D) when the bed of adsorbent particles in the active pressure swing adsorbent unit has adsorbed a preselected amount of volatile organic compounds, stopping steps (B) and (C) thereby deactivating the pressure swing adsorbent unit,

(E) providing a primary gas separation module comprising a membrane which is selectively gas permeable to methane relative to carbon dioxide, a feed-retentate chamber within the module on a first side of the membrane, and a permeate chamber within the module on a second side of the membrane,

(F) introducing the intermediate mixture into the feed-retentate chamber of the primary module in contact with the membrane and causing the intermediate mixture to selectively permeate through the membrane into the permeate chamber,

(G) removing from the feed-retentate chamber of the primary module a retentate gas having composition enriched in methane relative to the intermediate mixture,

(H) removing from the permeate chamber of the primary module a permeate gas having composition reduced in concentration of methane relative to the intermediate mixture,

(I) conducting the permeate gas through the bed of adsorbent particles in at least one of the deactivated pressure swing adsorption units under operating conditions including pressure, temperature and duration effective to desorb volatile organic compounds from the bed to form a spent regenerating gas within the deactivated pressure swing adsorption unit,

(J) withdrawing the spent regenerating gas from the deactivated pressure swing adsorption unit,

(K) when the bed of particles in the deactivated pressure swing adsorption unit attains a loading inventory below a pre-selected value of parts by weight volatile organic compounds per 100 parts by weight adsorbent particles, stopping steps (I) and (J) thereby activating the deactivated pressure swing adsorption unit.

9. The process of claim 8 which further comprises diverting flows of feed mixture and permeate gas to active and deactivated pressure swing adsorption units, respectively, and repeating steps (B)-(D) and (I)-(K) as appropriate to maintain a continuous removal of retentate gas and permeate gas from the primary gas separation module.

10. The process of claim 9 which further comprises

(i) providing a secondary gas separation module comprising a membrane which is selectively gas permeable to methane relative to carbon dioxide, a secondary feed-retentate chamber within the module on a first side of the membrane, and a secondary permeate chamber within the module on a second side of the membrane,

(ii) feeding the retentate gas from the primary module into the secondary feed-retentate chamber and causing the retentate gas to selectively permeate through the membrane of the secondary module into the secondary permeate chamber,

(iii) removing from the secondary feed-retentate chamber of a second retentate gas having composition enriched in methane relative to the retentate gas of the primary module.

11. The process of claim 10 which further comprises removing from the secondary permeate chamber a secondary permeate gas having composition reduced in methane relative to the retentate gas of the primary module and recycling at least a portion of the secondary permeate gas into the feed mixture.

12. The process of claim 8 which further comprises thermally oxidizing the spent regenerating gas under conditions of pressure, temperature and duration effective to destroy substantially all of the volatile organic compounds therein.

13. The process of claim 8 in which the feed mixture comprises exhaust gas recovered from a solid waste landfill.